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ABSTRACT

The main import of the present paper is to discuss what Guttman facet design and analysis is and then to show how this technique can be used in attitude scale construction. Since Guttman is best known for his contribution to scaling theory known as scalogram analysis, a brief historical background is given to indicate how Guttman moved from a unidimensional approach (scalogram analysis) to a multidimensional approach (facet design and analysis). After facet design and analysis is introduced, an example of facet design is presented in relation to an attitude item paradigm for an intergroup situation. Some further research using facet design and analysis is introduced and some elaborations of Guttman's original formulations are expanded. (Author)

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GUTTMAN FACET DESIGN AND
ANALYSIS: A TECHNIQUE FOR
ATTITUDE SCALE CONSTRUCTION

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SOME BACKGROUND HISTORY

Guttman is best known for his contribution to scaling called scalogram analysis. Guttman considered (Guttman, 1950) an attitude area "scalable" if responses to a set of items in that area arranged themselves in certain specified ways. Ideally and theoretically, the items in a Guttman scale are ordered in such a way that all persons who answer a given question favorably have higher ranks than persons who answer the same question unfavorably. It should be possible then, knowing a respondent's rank or scale score, to reproduce that persons responses to each item. This approach to attitude scaling is an unidimensional approach.

Multiple unidimensional scaling is a generalization of Guttman's scalogram analysis, and the method as developed by Lingoes (1963), was entitled Multiple Scalogram Analysis (MSA). This method, like scalogram analysis, deals with dichotomous variables. Unlike scalogram analysis, however, MSA extends Guttman's method to the determination of multiple dimensions instead of the single dimension with which scalogram analysis was concerned.

Guttman entered the multidimensional scaling area with an approach he labelled "facet design and analysis." This technique involved quite a different approach than the empirical method he used in scalogram analysis. Both scalogram analysis and multiple scalogram analysis are techniques for analyzing the responses to items whereas, as will be pointed out, facet design and analysis is a method for constructing items. Since Guttman is best known for his scalogram analysis work this distinction must be made clear. Lingoes (1968) in a summary article indicates the many sorts of computer programs available for all Guttman approaches and the connections that they may have with one another.

LOGIC OF FACET DESIGN AND ANALYSIS

In facet design and analysis, Guttman is concerned with a semantic a priori method of constructing items that has implications for the ensuing structure of the statistical results and their interpretation. The utility of the facet design approach is underlined by Guttman (Guttman & Schlesinger, 1967):

The facet approach in test construction makes it possible to arrive at items by a systematic a priori design instead of by the usual process of designing test items which is largely based on intuition and on subsequently weeding out inappropriate items by means of statistical analysis of test results (p.3).

A facet is a semantic unit or factor. Guttman (1965) looks at a facet in terms of set theory where a facet is a set containing elements. A Cartesian space can then be made of different facets or sets. Elements are then ordered sub-units of a facet. In diagramming, facets are indicated by capital letters, elements by corresponding small letters with numerical subscripts showing the position of the given element in the order of elements. Foa (1958) states that: "The determination of the facets that are relevant to a given class of phenomena involves of necessity a process of selection that is largely intuitive in nature." However, the researcher is of course guided by many principles in selecting the relevant facets. One of these principles, the principle of logical independence of the facets (Foa, 1958) states "that the facets should be such that every combination of their elements describes a phenomenological category that is logically possible."

Facet design permits the principle of contiguity to be invoked, thus providing a method for the interpretation of the structural (established) patterns obtained. Foa states (1958) that conceptual contiguity

is a necessary condition for statistical dependence. Facet design aims at providing conceptual contiguity that results in statistical dependence. Guttman and Schlesinger (1966) elaborate on the use of the contiguity principle in relation to facet design:

In general, the relationship between items within the framework of facet design should be expected to have its counterpart in the empirically obtained correlation matrix, where the size of the correlation is reduced to similarity of facet profiles (p.6).

Simply stated, the contiguity principle avers that the correlation between two variables is higher the more similar their facet structure. The expected resulting statistical relationship is referred to as simplex analysis by Guttman. A simplex is not an "approach" or another name for the contiguity principle but is a particular pattern to be found in a matrix. A hypothetical example illustrating the simplex pattern will be presented later.

Besides the facets and their elements, other important concepts in facet design are: level, level member, and profile. These concepts will not be elaborated on but will be illustrated in Tables 1 and 2.

AN EXAMPLE OF FACET DESIGN USING AN ATTITUDE ITEM PARADIGM FOR AN INTERGROUP SITUATION

Guttman (1950) started by operationally defining an attitude as "a delimited totality of behavior with respect to something." Guttman, in later work (1959), proceeded to name the particular facets and their respective elements that are relevant in an intergroup situation.

In an analysis of an article written by Bastide and van den Berghe (1957), Guttman (1959) distinguished three facets involved in a particular attitude response in respect to intergroup behavior: the (a)

subject's behavior (a_1 belief or a_2 overt action), the (b) referent (b_1 the subject's group or b_2 the subject himself), and (c) the referent's intergroup behavior (c_1 comparative or c_2 interactive). He labelled the first of the two options, or elements, given above in parentheses, of each facet as the "weaker." A particular attitude item, then, was as strong as the number of strong elements (elements with the number 2 subscript) which appeared.

According to Guttman's rationale, if an attitude item can be distinguished semantically in terms of these three facets, then an individual item could have none, one, two or three strong facets -- a total of four combinations. These combinations are called levels and items are then written to conform to this three-facet, four-level approach. Tables 1 and 2 illustrate the three facets and the names of the levels Guttman associated with them.

Insert Tables 1 and 2 here

If items are written to correspond to each of these four levels, then levels closest to each other should be more similar and thus should correlate more highly with each other than more distant levels. Guttman expects this to happen because of the "principle of contiguity" (Guttman & Schlesinger, 1966). Analysis of this relationship is what Guttman calls a simplex and Table 3 presents a hypothetical example using the four levels specified in Table 2. In essence, this approach implies that if the structure of certain items are close semantically then they should also be close statistically.

Insert Table 3 here

FURTHER RESEARCH
USING FACET DESIGN AND ANALYSIS

Guttman's paradigm for intergroup attitude item construction allows for three facets and four levels. Theorizing that additional facets were needed, but accepting the ones that Guttman did identify as appropriate, Jordan (1968) expanded facet design and analysis for attitude items dealing

with intergroup situations to include five-facets and six-levels. Jordan designed an attitude instrument toward the mentally retarded (ABS:MR) that contained the five-facet, six-level structure he hypothesized would appear. Jordan found that preliminary administration of the instrument yielded results consistent with the researcher's theory.

Hamersma (1969; 1970) constructed a racial attitude scale using Jordan's five-facet, six-level extension of Guttman's original paradigm. This scale was entitled the Attitude Behavior Scale: BW/WN-G. Hamersma's results were also consistent with the researcher's theory. Other researchers (Dell Orto, 1970; Erb, 1969) have used the Attitude Behavior Scale: BW/WN-G and have obtained similar results.

Facet design and analysis has also been used to construct instruments in other situations not involving attitude research such as: intelligence tests (Guttman, 1954), dyadic interaction (Foa, 1962), diagnostic analytical mechanical ability test construction (Guttman & Schlesinger, 1966), and analysis of the diagnostic effectiveness of a battery of achievement and analytical ability tests (Guttman & Schlesinger, 1967).

SUMMARY

Most attitude scales in the past have been heavily loaded with stereotypic items. These have usually been constructed using a conglomeration of techniques thus making most research not directly comparable. Facet design and analysis is a technique presented by Guttman that would allow the researcher to construct a scale by a semantic, logical, a priori method and enable the researcher to predict the statistical order structure

which would result from empirical observation. Scales have already been constructed using a facetized design (Guttman, 1959; 1966; 1967; Hamersma, 1969; 1970; Jordan, 1968).

REFERENCES

- Bastide, R., & van de Berghe, P. Stereotypes, norms and interracial behavior in San Paulo, Brazil. American Sociological Review, 1957, 22, 299-308.
- Dell Orto, A.E. A Guttman facet analysis of rehabilitation counselor trainees racial attitudes. Unpublished doctoral dissertation, Michigan State University, 1970.
- Erb, D. L. Racial attitudes and empathy: A Guttman facet theory examination of their relationship and determinants. Unpublished doctoral dissertation, Michigan State University, 1969.
- Foa, U. G. The continuity principle in the structure of interpersonal relations. Human Relations, 1958, 11, 229-238.
- Foa, U. G. The structure of interpersonal behavior in the dyad. In J. H. Criswell, H. Solomon, & P. Suppes (Eds.), Mathematical Methods in small group processes. Stanford University Press, 1962. Pp. 166-179.
- Guttman, L. The problem of attitude and opinion measurement. In S. A. Stouffer (Ed.), Measurement and prediction, Princeton: Princeton University Press, 1950. Pp. 46-59.
- Guttman, L. A new approach to factor analysis: The radex. In P. F. Lazarsfeld (Ed.), Mathematical Thinking in the social sciences. Glencoe, Illinois: The Free Press, 1954. Pp. 258-348.
- Guttman, L. A structural theory for intergroup beliefs and actions. American Sociological Review, 1959, 24, 318-328.
- Guttman, L. A faceted definition of intelligence. In R. R. Eiferman (Ed.), Scripta Hierosolymitana: Volume 14 studies in psychology. Jerusalem: The Hebrew University, 1965. Pp. 166-181.
- Guttman, L., & Schlesinger, I. M. Development of diagnostic analytical and mechanical ability tests through facet design and analysis. Research Project No. OE-4-21-014. The Israel Institute of Applied Social Research, Jerusalem, Israel, 1966.
- Guttman, L., & Schlesinger, I. M. The analysis of diagnostic effectiveness of a facet design battery of achievement and analytical ability tests. Research Project No. OEG-5-21-006. The Israel Institute of Applied Social Research, Jerusalem, Israel, 1967.

REFERENCES (continued)

- Hamersma, R. J. Construction of an attitude behavior scale of Negroes and Whites toward each other using Guttman facet design and analysis. Unpublished doctoral dissertation, Michigan State University, 1969.
- Hamersma, R. J. Construction of an attitude behavior scale of blacks and whites toward each other using Guttman facet design and analysis. Paper presented at the meeting of The American Personnel and Guidance Association, New Orleans, March, 1970.
- Jordan, J. E. Attitudes toward education and physically disabled persons in eleven nations. East Lansing: Latin American Studies Center, Michigan State University, 1968.
- Lingoes, J. C. Multiple scalogram analysis: A set-theoretic model for analyzing dichotomous items. Educational and Psychological Measurement, 1963, 23, 501-524.
- Lingoes, J. C. The rationale of the Guttman-Lingoes Nonmetric Series: A letter to Dr. Philip Runkel. Multivariate Behavior Research, 1968, 3, 495-507.

TABLE 1

Three Facets and Their Corresponding Elements
Contained in the Semantic Structure of an Attitude Item

	A	B	C
Facets	Subject's Behavior	Referent	Referent's Intergroup Behavior
Elements	a_1 belief a_2 overt action	b_2 subject's group b_2 subject him- self	c_1 comparative c_2 interactive

TABLE 2

Profiles and Descriptive Labels Associated
with Four Levels or Types of Attitudes Items

Level	Profile	Descriptive Label
1	$a_1b_1c_1$	Stereotype
2	$a_1b_1c_2$	Norm
3	$a_1b_2c_2$	Hypothetical Interaction
4	$a_2b_2c_2$	Personal Interaction

Note: - There are 8 possible profiles or levels but Guttman selected four as making the best logical sense, i.e., some permutations are not logically consistent. Maierle (1969) presents an elaborate analysis of the principles leading to logical permutations.

TABLE 3
Hypothetical Matrix of Level-by-Level
Correlations Illustrating the Simplex Structure

Level	1	2	3	4
1	---			
2	.60	---		
3	.50	.60	---	
4	.40	.50	.60	---

Note: - One does not attempt to predict the magnitudes of each correlation coefficient. The simplex requirements do not necessitate either identical mathematical differences among various correlations or identical correlations between sets or adjacent levels, so that the bottom row of the matrix reading from left to right could contain such figures as .10, .32, and .49.